REMARKS

Claims 1-10 are pending in this application. Claims 9 and 10 have been added. Claim 1 has been amended herein. Reconsideration in view of the following remarks is respectfully requested.

Claim Rejections - 35 USC § 102

Claims 1 and 3-6 were rejected under 35 U.S.C. § 102(e) over US Patent No. 6,232,236 to Shan et al. ("Shan"). Applicants respectfully traverse the rejection.

Claim 1 has been amended to recite, *inter-alia*, "wherein the auxiliary electrode is a planar electrode which extends substantially parallel to a surface of the first electrode, and wherein the auxiliary electrode lacks any part that prevents a drift of electrons in the vicinity of the auxiliary electrode in a direction parallel to a front surface of the auxiliary electrode and a back surface of the auxiliary electrode so as to facilitate electrons in the plasma to drift from the front surface of said auxiliary electrode to the back surface thereof and from the back surface of said auxiliary electrode to the front surface thereof."

The Office Action asserts that Shan discloses the invention as claimed including the plasma apparatus recited in claim 1. In response to Applicants' arguments, filed November 18, 2003, the Office Action contends the fact Shan has an auxiliary electrode of an L-shape does not take away from the fact that the bottom surface of the auxiliary electrode is exposed and electrons would be expected to drift from a front surface to a back surface due to the effect of magnets 270.

The process kit 220 of Shan has a "L-shape" which extends in an "L" configuration from a top surface of the flange 216 of chuck 212 to a side of flange 216. The electrode 215 in the chuck 212 of Shan is parallel to the top surface of the flange 216 (see Figure 2 in Shan). The process kit 220 has a depending extension 226 which extends "perpendicular" to the top surface of the flange 216, i.e., perpendicular to a surface of electrode 215. Therefore, the process kit 220 of Shan is not a planar electrode which extends substantially parallel to a surface of electrode 215.

Furthermore, due to the "L-shape" structure of the process kit 220 of Shan, the electrons cannot drift to the bottom surface 224 of the process kit 220 because the presence of extension 226 can hinder the movement of electrons. Therefore, contrary to the plasma apparatus of claim 1 in which the auxiliary electrode lacks any part that would prevent a drift

of electrons in the vicinity of the auxiliary electrode in a direction parallel to a front surface of the auxiliary electrode and a back surface of the auxiliary electrode, the process kit 220 of Shan has an extension 226 that would hinder the flow of electrons as claimed in claim 1.

As such, Shan does not disclose, teach or suggest, *inter-alia*, "wherein the auxiliary electrode is a planar electrode which extends substantially parallel to a surface of the first electrode, and wherein the auxiliary electrode lacks any part that prevents a drift of electrons in the vicinity of the auxiliary electrode in a direction parallel to a front surface of the auxiliary electrode and a back surface of the auxiliary electrode so as to facilitate electrons in the plasma to drift from the front surface of said auxiliary electrode to the back surface thereof and from the back surface of said auxiliary electrode to the front surface thereof," as recited in claim 1.

Therefore, Applicants respectfully submit that claim 1, and claims 3-6, which depend either directly or indirectly from claim 1, are patentable over Shan.

Furthermore, with regard to claim 5, Shan does not disclose, teach or suggest, *inter alia*, "said first electrode is supplied with a first radio frequency and said auxiliary electrode is supplied with a second radio frequency and wherein the first and the second radio frequencies are equal to each other and have different phases thereof." By supplying the first electrode with a first radio frequency and the auxiliary electrode with a second radio frequency, the first and the second radio frequencies being equal to each other but have different phases, this allows the electrons in the plasma to drift from a front surface of the auxiliary electrode to a back surface of the auxiliary electrode and vice versa.

Therefore, Applicants respectfully request that the rejections of claims 1 and 3-6 based upon Shan be withdrawn.

Claim Rejections - 35 USC § 103

Claims 2 and 8 were rejected under 35 U.S.C. § 103(a) over Shan in view of US Patent No. 5,949,409 to Dornfest et al. ("Dornfest"). Applicants respectfully traverse the rejection.

Claim 2 is dependent from claim 1. Therefore, for at least the reasons provided above with regard to claim 1, claim 2 is patentable over Shan. Furthermore, as conceded in the Office Action, Shan does not disclose covering the front surface of the auxiliary electrode with insulating material. Dornfest fails to overcome the deficiencies of Shan noted above with regard to claim 1. Dornfest merely uses an insulating material to protect an electrode

from the plasma atmosphere. In contrast, in claim 2, the front surface of the auxiliary electrode is covered by an insulating material. As a result, a difference in plasma density is created between the front surface of the auxiliary electrode (covered with the insulating material) and the back surface of the auxiliary electrode. This difference in plasma density causes the electrons to drift between the front and the back surfaces of the auxiliary electrode.

Consequently, neither Shan nor Dornfest, alone or in combination, disclose, teach or suggest the subject matter recited in claim 2.

Claim 8 recites, *inter-alia*, "an auxiliary electrode provided on an outer periphery of said first electrode to excite plasma in a vicinity of the auxiliary electrode, the front surface of said auxiliary electrode being covered by an insulating material, wherein electrons in the plasma drift from a front surface of said auxiliary electrode to a back surface thereof and from the back surface of said auxiliary electrode to the front surface thereof."

As discussed above with regard to claim 1, due to the "L-shape" structure of the process kit 220 (the process kit 220 has extension 226 extending perpendicularly to the top surface of the flange 216) the drift of electrons from the top surface 222 of the process kit 220 to the bottom surface 224 of the process kit 220 would be hindered. Furthermore, as conceded in the Office Action, Shan does not disclose covering the auxiliary electrode with insulating material.

Dornfest does not overcome the deficiencies of Shan. As stated above, Dornfest merely uses an insulating material to protect an electrode from the plasma atmosphere. In contrast, in claim 8, the front surface of the auxiliary electrode is covered by an insulating material. As a result, a difference in plasma density is created between the front surface (covered with the insulating material) and the back surface. This difference in plasma density causes the electrons to drift between the front and the back surfaces of the auxiliary electrode.

Thus, neither Shan nor Dornfest, alone or in combination, disclose, teach or suggest, among other features, "an auxiliary electrode provided on an outer periphery of said first electrode to excite plasma in a vicinity of the auxiliary electrode, the front surface of said auxiliary electrode being covered by an insulating material, wherein electrons in the plasma drift from a front surface of said auxiliary electrode to a back surface thereof and from the back surface of said auxiliary electrode to the front surface thereof," as recited in claim 8. Consequently, neither Shan nor Dornfest, alone or in combination, disclose, teach or suggest the subject matter recited in claim 8.

Therefore, Applicants respectfully submit that claims 2 and 8 are patentable over the combination of Shan and Dornfest. Reconsideration and withdrawal of the rejections of claims 2 and 8 are respectfully requested.

Claim 7 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Shan in view of WO 98/39500 to Ohmi et al. ("Ohmi"). Applicants respectfully traverse this rejection.

Claim 7 recites, *inter-alia*, "applying a static magnetic field to a surface of the substrate to which the plasma process is applied; exciting plasma on at least a back surface of the auxiliary electrode; and causing electrons in the plasma to drift from a front surface of said auxiliary electrode to the back surface thereof and from the back surface of said auxiliary electrode to the front surface thereof."

As discussed above with respect to claim 1, Applicants submit that Shan does not disclose, teach or suggest "causing electrons in the plasma to drift from a front surface of said auxiliary electrode to the back surface thereof and from the back surface of said auxiliary electrode to the front surface thereof." Furthermore, as conceded in the Office Action, Shan does not disclose or suggest a plasma processing method including applying a static magnetic field.

Ohmi discloses a plasma etching device which has an auxiliary electrode and a magnetic device for applying a magnetic field to enable generation of uniform density plasma. The auxiliary electrode of Ohmi is attached to the electrode substrate holder (see Figure 1 in Ohmi). The back surface of the auxiliary electrode is in contact with the surface of the chuck. Hence, the electrons generated in the plasma and guided by the magnetic field cannot drift from the front surface of the auxiliary electrode to the back surface of the auxiliary electrode because the back surface of the auxiliary electrode is not accessible to the flow of electrons.

Furthermore, even if one were to modify the apparatus of Shan to include a static magnetic field, which Applicants do not concede, the electrons in the plasma would not drift from a front surface of the process kit 220 of Shan to the back surface of the process kit 220 and from the back surface of the process kit 220 to the front surface thereof because the extension 226 of the "L-shape" structure of the process kit 220 in Shan would hinder the movement of electrons.

Consequently, neither Shan nor Ohmi, alone or in combination, disclose, teach or suggest the subject matter recited in claim 7. Therefore, Applicants respectfully submit that

claim 7 is patentable over Shan and Ohmi. Reconsideration and withdrawal of the rejections based upon these references are respectfully requested.

Claims 1 and 3-5 were rejected under 35 U.S.C. § 103(a) as being unpatentable over US Patent No. 4,950,956 to Asamaki et al. ("Asamaki") in view of US Patent No. 6,297,165 to Okumura et al. ("Okumura"). Applicants respectfully traverse this rejection.

Claim 1 recites, *inter-alia*, "wherein the auxiliary electrode is a planar electrode which extends substantially parallel to a surface of the first electrode, and wherein the auxiliary electrode lacks any part that prevents a drift of electrons in the vicinity of the auxiliary electrode in a direction parallel to a front surface of the auxiliary electrode and a back surface of the auxiliary electrode so as to facilitate electrons in the plasma to drift from the front surface of said auxiliary electrode to the back surface thereof and from the back surface of said auxiliary electrode to the front surface thereof."

As conceded in the Office Action, Asamaki does not disclose, teach or suggest an auxiliary electrode provided on an outer periphery of the first electrode to excite plasma by the auxiliary electrode so as to cause electrons in the plasma to drift from a front surface to a back surface of the auxiliary electrode and from the back surface to the front surface of the auxiliary electrode. Moreover, Asamaki does not disclose, teach or suggest an auxiliary electrode which is a planar electrode and extends substantially parallel to a surface of a first electrode.

Furthermore, Asamaki does not disclose, teach or suggest a magnetic field generator configured to apply a static magnetic field to a surface of the substrate to which the plasma process is applied. Indeed, the magnetic field generated in the apparatus of Asamaki is a rotating magnetic field. The magnetic field in the apparatus of Asamaki is generated by alternating current power sources 35 and 36 in which phases are shifted by 90° to produce a rotating magnetic field. Thus, the magnetic field in the apparatus of Asamaki is completely different from the static magnetic field recited in claim 1.

Okumura merely teaches a ring-form voltage monitoring conductor 11 that is configured to monitor the self-bias potential generated in the substrate 8. The Okumura patent is directed to etching and cleaning methods in which an end of an etching process or cleaning process is determined based on the self-bias potential of the substrate, which is monitored by the voltage monitoring conductor 11 (see Figure 2 and col. 4, line 40 through col. 5, line 38 of Okumura). In Okumura, a high-frequency electric power is supplied to the substrate electrode 7 and to voltage monitoring conductor 11. When high-frequency electric

power is supplied to a solid material in contact with a plasma, negative DC potentials are generated in the solid material. This DC potential is called self-biasing potential. Since the self-biasing potential on substrate 8 cannot be measured directly, measuring the self-biasing potential on conductor 11 is used as a proxy for the self-biasing potential on substrate 8. Thus, in order to replicate the self-biasing potential on the substrate 8, the conductor 11 is driven with a high-frequency electric in the same way as the substrate electrode 7. In addition to applying a high-frequency electric power to the substrate electrode 7, a high DC voltage is also applied to the substrate electrode 7 to hold the substrate 8 on the chuck electrode 7.

Contrary to Examiner's contention, there is no suggestion in either Okumura or Asamaki to modify the apparatus of Asamaki to contain the ring-form voltage conductor of Okumura. Furthermore, the ring-form voltage monitoring conductor 11 of Okumura is used for a completely different purpose than the auxiliary electrode of claim 1. In fact, Okumura teaches away from controlling the drift of electrons as recited in claim 1 by specifically teaching that the electrode 11 is used to measure the self-biasing potential on substrate 8.

Moreover, even if one were to modify the apparatus of Asamaki by incorporating the structure of Okumura and apply a magnetic field to the structure of Okumura, which Applicants do not concede, the electrons in the plasma would not drift as recited in claim 1 because of the presence of the high DC voltage in the substrate electrode 7. Indeed, the flow of electrons would be perturbed by the high DC potential field produced in the vicinity of the back surface of substrate electrode 7 and this will hinder the flow the electrons. Moreover, the magnetic field generated in the apparatus of Asamaki is a rotating magnetic field. Thus, the magnetic field in the apparatus of Asamaki is completely different from the static magnetic field recited in claim 1 and thus would inherently produce a different effect on the electrons than the flow recited in claim 1. Even if the magnetic field source of Asamaki can be configured to produce a static magnetic field, which Applicants do not concede, the presence of the high DC potential produced in the vicinity of the back surface of the substrate electrode 7 would hinder the flow of electron as recited in claim 1.

Consequently, neither Asamaki nor Okumura, alone or in combination, disclose, teach or suggest the subject matter recited in claim 1.

Therefore, Applicants respectfully submit that claim 1, and claims 3-5 which depend either directly or indirectly from claim 1, are patentable. Reconsideration and withdrawal of the rejection based upon Asamaki and Okumura are respectfully requested.

Claims 2 and 8 were rejected under 35 U.S.C § 103(a) as being unpatentable over Asamaki in view of Okumura and further in view of Dornfest. Applicants respectfully traverse this rejection.

Claim 2 is dependent from claim 1. Therefore, for at least the reasons presented above with regard to claim 1, Applicants respectfully submit that claim 2 is patentable over Asamaki in view of Okumura. Dornfest fails to overcome the deficiencies noted above in Asamaki and Okumura. In addition, Dornfest merely uses an insulating material to protect an electrode from the plasma atmosphere. In contrast, in claim 2, the front surface of the auxiliary electrode is covered by an insulating material. As a result, a difference in plasma density is created between the front surface (covered with the insulating material) and the back surface. This difference in plasma density causes the electrons to drift between the front and the back surfaces of the auxiliary electrode. Therefore, Applicants respectfully submit that claim 2 is patentable thereover.

Claim 8 recites, *inter-alia*, "an auxiliary electrode provided on an outer periphery of said first electrode to excite plasma in a vicinity of the auxiliary electrode, the front surface of said auxiliary electrode being covered by an insulating material, wherein electrons in the plasma drift from a front surface of said auxiliary electrode to a back surface thereof and from the back surface of said auxiliary electrode to the front surface thereof."

As conceded in the Office Action, the Asamaki and Okumura combination does not disclose covering the auxiliary electrode with insulating material. Furthermore, neither Asamaki nor Okumura, alone or in combination, disclose teach or suggest the electrons in the plasma drift from a front surface of said auxiliary electrode to a back surface thereof and from the back surface of said auxiliary electrode to the front surface thereof.

Dornfest fails to overcome the deficiencies noted above in Asamaki and Okumura. Dornfest merely uses an insulating material to protect an electrode from the plasma atmosphere. In contrast, in claim 8, the front surface of the auxiliary electrode is covered by an insulating material. As a result, a difference in plasma density is created between the front surface (covered with the insulating material) and the back surface. This difference in plasma density causes the electrons to drift between the front and the back surfaces of the auxiliary electrode. Therefore, Applicants respectfully submit that claim 8 is patentable over the combination of Asamaki, Okumura and Dornfest.

Reconsideration and withdrawal of the rejections based upon Asamaki, Okumura and Dornfest are respectfully requested.

Claim 6 was rejected under U.S.C § 103(a) as being unpatentable over Asamaki in view of Okumura and further in view of Shan. Applicants respectfully traverse this rejection for at least the following reasons.

Claim 6 depends from claim 1. Therefore, for at least the reasons presented above with regard to claim 1, Applicants respectfully submit that claim 6 is patentable over the combination of Asamaki and Okumura. Specifically, as conceded in the Office Action, Asamaki does not disclose, teach or suggest an auxiliary electrode provided on an outer periphery of the first electrode to excite plasma by the auxiliary electrode so as to cause electrons in the plasma to drift from a front surface to a back surface of the auxiliary electrode and from the back surface to the front surface of the auxiliary electrode.

Okumura merely teaches a ring-form voltage monitoring conductor 11 that is configured to monitor the self-bias potential generated in the substrate 8. Contrary to Examiner's contention, there is no suggestion in either Okumura or Asamaki to modify the apparatus of Asamaki to contain the ring-form voltage conductor of Okumura. Furthermore, the ring-form voltage monitoring conductor 11 of Okumura is used for a completely different purpose than the auxiliary electrode of claim 1. In fact, Okumura teaches away from controlling the drift of electrons as recited in claim 1 by specifically teaching that the electrode 11 is used to measure the self-biasing potential on substrate 8.

Moreover, even if one were to modify the apparatus of Asamaki by incorporating the structure of Okumura and apply a magnetic field to the structure of Okumura, which Applicants do not concede, the electrons in the plasma would not drift as recited in claim 1 because of the presence of the high DC voltage in the substrate electrode 7. Indeed, the flow of electrons would be perturbed by the high DC potential field produced in the vicinity of the back surface of substrate electrode 7 and this will hinder the flow the electrons. Moreover, the magnetic field generated in the apparatus of Asamaki is a rotating magnetic field. Thus, the magnetic field in the apparatus of Asamaki is completely different from the static magnetic field recited in claim 1 and thus would inherently produce a different effect on the electrons than the flow recited in claim 1.

Therefore, Applicants respectfully submit that claim 6 is patentable over Asamaki in view of Okumura. Shan fails to overcome the deficiencies noted above in Asamaki and Okumura. Therefore, Applicants respectfully submit that claim 6 is patentable thereover.

Reconsideration and withdrawal of the rejections based upon Asamaki, Okumura and Shan are respectfully requested.

Claim 7 was rejected under 35 U.S.C § 103(a) as being unpatentable over Asamaki in view of Okumura and further in view of Ohmi. Applicants respectfully traverse this rejection for at least the following reasons.

Claim 7 recites, *inter-alia*, "applying a static magnetic field to a surface of the substrate to which the plasma process is applied; exciting plasma on at least a back surface of the auxiliary electrode; and causing electrons in the plasma to drift from a front surface of said auxiliary electrode to the back surface thereof and from the back surface of said auxiliary electrode to the front surface thereof."

As discussed above with regard to claim 1, Asamaki does not disclose, teach or suggest a magnetic field generator configured to apply a static magnetic field to a surface of the substrate to which the plasma process is applied. Indeed, the magnetic field generated in the apparatus of Asamaki is a rotating magnetic field. The magnetic field in the apparatus of Asamaki is generated by alternating current power sources 35 and 36 in which phases are shifted by 90° to produce a rotating magnetic field. Thus, the magnetic field in the apparatus of Asamaki is completely different from the static magnetic field recited in claim 7.

Okumura merely teaches a ring-form voltage monitoring conductor 11 that is configured to monitor the self-bias potential generated in the substrate 8. Contrary to Examiner's contention, there is no suggestion in either Okumura or Asamaki to modify the apparatus of Asamaki to contain the ring-form voltage conductor of Okumura. Furthermore, the ring-form voltage monitoring conductor 11 of Okumura is used for a completely different purpose than the auxiliary electrode of claim 7. In fact, Okumura teaches away from controlling the drift of electrons as recited in claim 7 by specifically teaching that the electrode 11 is used to measure the self-biasing potential on substrate 8.

Moreover, even if one were to modify the apparatus of Asamaki by incorporating the structure of Okumura and apply a magnetic field to the structure of Okumura, which Applicants do not concede, the electrons in the plasma would not drift as recited in claim 7 because of the presence of the high DC voltage in the substrate electrode 7. Indeed, the flow of electrons would be perturbed by the high DC potential field produced in the vicinity of the back surface of substrate electrode 7 and this will hinder the flow the electrons. Moreover, the magnetic field generated in the apparatus of Asamaki is a rotating magnetic field. Thus, the magnetic field in the apparatus of Asamaki is completely different from the static magnetic field recited in claim 7 and thus would inherently produce a different effect on the electrons than the flow recited in claim 7.

Consequently, none of Asamaki, Okumura and Ohmi disclose, teach or suggest, alone or in combination, the subject matter recited in claim 7. Therefore, Applicants respectfully submit that claim 7 is patentable. Reconsideration and withdrawal of the rejections based upon Asamaki, Okumura and Ohmi are respectfully requested.

Claims 9 and 10 have been added. Support for claims 9 and 10 may be found throughout the original disclosure.

Claim 9 recites, *inter-alia*, "wherein electrons in the plasma drift from a front surface of said auxiliary electrode to a back surface thereof and from the back surface of said auxiliary electrode to the front surface thereof, wherein the front surface of said auxiliary electrode is covered by an insulating material and the back surface of said auxiliary electrode is not covered by said insulting material."

By covering the front surface of the auxiliary electrode by an insulating material and not covering the back surface of the auxiliary electrode by the insulating material, a difference in the plasma density between the front surface (covered with the insulating material) and the back surface (not covered by the insulating material) is created. As a result, electrons drift from the front surface of the auxiliary electrode to the back surface of the auxiliary electrode and vice-versa.

None of the relied upon references disclose, teach or suggest, alone or in combination, the subject matter recited in claim 9.

Claim 10 recites, *inter-alia*, "wherein electrons in the plasma drift from a front surface of said auxiliary electrode to a back surface thereof and from the back surface of said auxiliary electrode to the front surface thereof, wherein said first electrode is supplied with a first radio frequency and said auxiliary electrode is supplied with a second radio frequency and wherein the first and the second radio frequencies are equal to each other and have different phases thereof."

By supplying the first electrode with a first radio frequency and the auxiliary electrode with a second radio frequency, the first and the second radio frequencies being equal to each other but have different phases, this allows the electrons in the plasma to drift from a front surface of the auxiliary electrode to a back surface of the auxiliary electrode and vice versa.

None of the relied upon references disclose, teach or suggest, alone or in combination, the subject matter recited in claim 10.

CONCLUSION

In view of the foregoing, the claims are now in form for allowance, and such action is hereby solicited. If any point remains in issue which the Examiner feels may be best resolved through a personal or telephone interview, he is kindly requested to contact the undersigned at the telephone number listed below.

All objections and rejections having been addressed, it is respectfully submitted that the present application is in a condition for allowance and a Notice to that effect is earnestly solicited.

Please charge any fees associated with the submission of this paper to Deposit Account Number 033975. The Commissioner for Patents is also authorized to credit any over payments to the above-referenced Deposit Account.

Respectfully submitted,

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